Vitrokele™ Technology to Recycle Cyanides and Metals at Gold Plants

"The mission of Jasmetech Metal Technologies Inc. is to develop ethical technologies that are economically attractive to industry and benefit the ecosystem by reducing or eliminating toxic emissions. Cyanide effluents from precious metal mines are extremely hazardous to many life forms. The principal objective of Jasmetech's technology is to remove cyanide and cyanide metal complexes from slurries, thus detoxifying the waste soup and recovering the cyanide for reuse."

Denis Kidby
Principal
Jasmetech Metal Technologies Inc.
Guelph, Ontario

Pilot plant on-site.

THE COMPANY

Jasmetech Metal Technologies Inc. was incorporated in Ontario under federal charter in 1992. The objective of the company is to continue development and to market mining applications of the Vitrokele™ technology in North America.

THE CHALLENGE

Cyanide has been used for the dissolution of gold in precious metal mining operations since the end of the 19th century. Cyanide and many of the metals made soluble by cyanide are toxic and have serious effects on the environment when released. Conventional methods to control these effluents include construction of large retention dams (tailing ponds) and chemical destruction of some of the agents used to dissolve gold out of the ore. This is generally accomplished by introducing sulphur dioxide or hydrogen peroxide and ferrous chloride to the slurries or solutions. Following this treatment, these slurries or solutions are still toxic and are not suitable for direct release to the ecosystem.

TECHNOLOGY DESCRIPTION

Cyanide is added in liquid form to ground, gold-bearing ores or sprinkled onto ore heaps. It forms soluble complexes with gold and other heavy metals such as copper in the ores (leach stage). Gold made soluble by reaction with the cyanide is recovered using activated carbon added to the mix to adsorb the gold-cyanide complex in Carbon-in-Pulp (CIP) or Carbon-in-Leach (CIL) plants or from solutions separated from the ground rock with precipitation of gold in Merrill Crowe plants. In all cases various forms of cyanide or various heavy metals leave the treatment plant as tailing (waste) from the operation.

Jasmetech has developed a completely engineered process employing a specialized resin to adsorb both free and complexed cyanide. This Vitrokele™ technology comprises the adsorption process and subsequent elution and recovery process resulting in the recycle of cyanide and the recovery of both precious and base metals. The technology is applicable to both ore slurries and solutions. Jasmetech has demonstrated that the treated solutions and slurries are no longer toxic to aquatic life from the presence of cyanide or cyanide metal complexes.

The cyanide and cyanide metal complexes captured by the Vitrokele technology are screened from the solution and the cyanide and heavy metals are chemically stripped from the resin beads. Cyanide is collected for reuse in the leach stage and the metals are collected as solids for metal refining (in the case of copper or precious metals).

In application VitrokeleTM resin beads are mixed with slurries or solutions in stirred reactors or columns. In the reactors or the columns the resin beads are transferred from stage to stage against the flow of slurry. The size of the beads permits them to be screened from the ground ore. After mixing, the resin beads are loaded with adsorbed cyanide and heavy metals. Chemical solutions are used to remove cyanides and/or heavy metals from the beads. Following the removal of the cyanide and /or heavy metals, the resin beads are ready for reuse in the circuit. Solutions containing cyanide and heavy metals, including precious metals, are processed to remove the heavy metals and the solutions containing cyanide are returned to the leach circuit for reuse.

RESULTS

The technology has now been demonstrated at pilot plant scale at seven operating gold mines - three in Canada, two in Australia and two in the United States. The technology is being used for primary gold recovery at a gold mine in Zimbabwe. A commercial scale plant is now operating at the Mayday mine in Australia. Pilot plant performance results at the six Canadian demonstration projects are summarized in the following table.

	SPECIEC	FEED (ppm)	TREATED (ppm)
PROJECT 1	CN (free)	96	0.14
	CN (total)	185	0.16
	Cu	48	0.18
PROJECT 2	CN (free)	506	2.00
	CN (total)	749	2.00
	Cu	153	0.08
PROJECT 3	CN (free)	293	0.28
	CN (total)	336	0.20
	Cu	101	0.18
PROJECT 4	CN (free)	700	0.20
	CN (total)	846	0.60
	Cu	22	0.19
PROJECT 5	CN (free)	78	0.04
	CN (total)	225	1.70
	Cu	56	0.65
PROJECT 6	CN (free)	84	2.11
	CN (total)	103	2.16
	Cu	27	0.13

Note: Results are averages of extended campaigns at six different mines. Copper represents total metals in solution.

TECHNOLOGY OPPORTUNITIES

The main market for the technology is in the precious metal mining industry for:

a) treatment of effluent slurries or solutions from conventional mineral processing plants to recover cyanide for reuse, remove heavy metals and detoxify the effluent;

b) use for primary gold recovery while at the same time recovering cyanide for reuse, removal of heavy metals and detoxification of the effluents.

Primary gold mining operations world-wide, particularly those in sensitive environmental areas are targeted.

PARTNERSHIP IN POLLUTION PREVENTION AND RESOURCE CONSERVATION

Construction of a pilot plant to demonstrate the technology was made possible with support from the Ontario Ministry of the Environment. Assistance was also obtained from mining companies who invited pilot plant demonstrations at their mines. Design engineering assistance is being supplied by Signet Technologies Inc. and financing from Jasmetech's supporters.

Industrial companies located in Ontario may seek ministry/industry services which will help them:

* reduce, reuse and recycle solid waste;
* effectively clean up historic pollution and destroy hazardous contaminants;
* reduce or eliminate liquid effluent and gaseous emissions;
* use energy and water more efficiently.

Equipment and services supply companies can benefit from the information provided on technologies identified for business development.

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For more project profiles and other publications, visit the ministry's website at http://www.ene.gov.on.ca

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